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UNDERGROUND LONDON.

The commercial prosperity of large cities depends so much upon the facilities afforded to their inhabitants for rapid and convenient travelling, that such an important and novel undertaking as the construction of the Central London Electrical Railway must naturally be regarded more as a public benefit than as a private enterprise.

When we remember that at the beginning of the present century the stage-coach was considered not only a luxurious but even a speedy mode of travelling, the opportunities of which we are now able to avail ourselves are so numerous, that we are lost in admiration at what has been accomplished in recent years for our welfare and comfort. Carriages, cabs, and omnibuses are now to be found everywhere, and horseless carriages (see *Chambers's Journal*, No. 610, Sept. 7, 1895, and page 683 below) threaten to give a new aspect to road traffic, already diversified by the ubiquitous bicycle. And our islands are covered with a network of railways, the construction and maintenance of which are alone able to give continual employment to a vast number of people.

The principal object of the new underground line which is about to be made, is to provide a means of travelling which the Metropolitan and Metropolitan District Railways are unable to offer, since these, while encircling the busiest portion of London, leave the general traffic along the main thoroughfares to be dealt with by the omnibus and tramway companies. Recognising the importance of travelling in a straight rather than in a circuitous route, the promoters of the Central London Railway have naturally decided to adhere to this principle wherever possible; and thus commencing at Shepherd's Bush, at the extreme west of London, their line runs nearly due east, passing under the Uxbridge Road, Oxford Street, Holborn, and Cheapside to the Bank of England.

There being no railway in this country along a route so crowded as that between the Marble Arch and the Bank, it is almost impossible to estimate the number of people that will be likely to avail themselves of the great convenience offered by this line; but the development of passenger traffic on the Metropolitan Railway during the last thirty years would seem to indicate that at least sixty million people will use the new railway annually.

The first attempt to construct underground railways was made in London in 1853, when Parliament sanctioned a scheme to construct a line from the Edgeware Road to King's Cross, a distance of two and a quarter miles, and from this small commencement grew the two lines now known as the Metropolitan and Metropolitan District. It was at first intended that these lines should be confined exclusively to a local business, much in the same way as the elevated railways of New York—that is, without direct communication with other lines. This arrangement, however, did not prove to be very profitable, and it was then sought to obtain additional revenue by making connections with various main lines for the interchange of passengers, and to enable these railways to run their trains into the central portions of the City, while at the same time the new company, by making various extensions, began to develop a suburban business.

The construction of all these early underground lines is similar in principle, although subject to considerable variations, necessitated by the different localities through which they pass. They are worked by steam locomotives which discharge the products of combustion directly into the tunnel, and no method of artificial ventilation is attempted. The evil consequences attending this system are minimised as much as possible by burning the best quality of coal, which is practically free from sulphur, and which makes but little smoke. The engines employed upon these railways are of a condensing type, so that the steam, instead of being exhausted through the chimney, as in

the case of an ordinary locomotive, is conveyed into a water-tank and condensed, by which means the air in the tunnels is kept drier, and is therefore less disagreeable than it would be were this precaution not adopted.

The cost of making a double line of railway of this kind may be assumed generally to be about a quarter of a million pounds per mile; but where great difficulties are experienced, such as were met with on the portion under Cannon Street and the immediate neighbourhood, where the work had to be carried on below one of the busiest thoroughfares in London, the cost per mile amounted to four hundred thousand pounds; and it is probable that, when all other expenses are included, the cost for such a portion as that would not be much less than one million pounds.

It is unfortunate that the earnings of these two companies cannot be regarded as entirely satisfactory. The immense capital required to construct such railways, and the low fares they are obliged to charge owing to the keen competition with which they have to contend, are the two principal reasons why the profits appear comparatively small; and although such a state of affairs is to be regretted, it does not necessarily indicate that underground railways generally are unremunerative.

The City and South London Railway, which, commencing at the Monument and passing under the Thames, terminates at Stockwell, is one of the most interesting lines that has been recently constructed. This railway, which was opened to the public only in 1890, consists of two cast-iron tubular tunnels, generally placed side by side at a depth varying between forty and eighty feet beneath the surface of the streets. These were built by means of the 'Greathead shield,' a method of construction now being so successfully employed at the tunnel which the London County Council are making under the Thames at Blackwall, and one which it is also proposed to adopt for carrying out the work in connection with the Central London Railway.

Between the Monument and Stockwell there are only four stations, and these being generally some fifty feet below the ground, hydraulic lifts are provided for the convenience of the passengers using the line; the cost of working these lifts is, however, considerable, amounting to about five per cent. of the earnings of the company.

A uniform fare of twopence is charged for any distance, and there being but one class, no tickets are issued, the payment being made on passing through the turnstiles on entering the stations. During last year nearly seven million people travelled by this railway, and the financial prospects of the company are now considerably brighter than during the early days of its existence. Ventilation is secured automatically by the piston action of the trains, each train propelling in front of it a column of air, which ultimately finds its way to the streets through the shafts provided for the stairs and lifts: meanwhile the train draws down a supply of fresh air through the similar openings behind it.

As electrical locomotion is adopted, the air in the tunnels is comparatively fresh, the carbonic acid gas exhaled by the passengers being the chief source of vitiation; but although in this respect it is considerably better than at various places on other underground railways, it will be generally admitted that the quality of the atmosphere is even yet susceptible of further improvement. This railway has received both the warmest commendation and the most stringent criticism. It offers to the public a direct route to many places on the south side of the Thames, and does not suffocate it during the journey; but at the same time the inconvenience of small carriages, and several other minor defects, are very apparent. It must be remembered, however, that the company experienced considerable difficulties in making the line at a reasonable cost; and when the work was undertaken, one of the objects was to demonstrate the feasibility of this method of construction, but as financial resources were limited, the smallest practical tunnel was adopted in order to reduce the expense as much as possible.

Any carriage that can be run in a tube which is only a trifle over ten feet in diameter cannot easily be made very comfortable, while its restricted dimensions are also responsible for the air in the tunnel not always remaining as fresh as it might be. In all future railways that will be built of this type, these drawbacks will no doubt be either wholly obviated, or at least much reduced, by making the tunnels of considerably larger diameter, thus allowing both the volume of air and the size of the carriages to be increased.

As will be readily understood, the electrical locomotion on this line is of a very interesting character. The engines, which weigh from ten to fourteen tons, are capable of hauling trains consisting of three carriages, each thirty-two feet long, and of sufficient size to contain thirty-two passengers. The average speed from terminus to terminus, including stoppages, is eleven miles per hour, or, excluding these stoppages, thirteen miles per hour. Between the stations, however, from twenty to twenty-five miles per hour is attained.

The quality of the air in any underground railway is necessarily of paramount importance, and a careful study of the various systems of ventilation that could be adopted is naturally one of the first considerations with those responsible for their construction. Since the quantity of carbonic acid gas exhaled by a human being in one hour scarcely exceeds half a cubic foot, while that produced by an ordinary locomotive in the same time is fifty thousand cubic feet, we are able to appreciate that steam-engines for such railways are inadmissible, as one engine will destroy as much air as one hundred thousand people. By the employment of electrical instead of steam locomotion, however, nearly the whole cause for a vitiated atmosphere is at once removed.

The Central London Railway, which it is estimated will cost nearly three million pounds, and which will be some six and a half miles in length, will consist of two tunnels, each eleven and a half feet in diameter, placed close together some fifty to eighty feet below the

surface of the ground. There will be altogether fourteen stations, that at the Bank of England (the site for which is beneath the open space in front of the Royal Exchange), forming one of the features of the railway. Here the company undertake to construct, in addition to the station, several subways for foot-passengers, which will connect together the various streets terminating in the immediate vicinity, thus enabling people to pass under the road and escape the dangers attending the tremendous traffic above them. These subways will be at least fifteen feet wide, and being lined with white glazed bricks, and lighted at all hours with electric lamps, they will constitute an important public improvement, which it is astonishing has not been provided long ago.

Other subways will also be constructed for the reception of the ever-increasing number of gas and water pipes and electrical wires, and it is to be hoped that such being thus all collected together will prevent the interruption to traffic which is so often caused when they have either to be repaired or augmented.

The station itself will be at a much lower level than the subways, and four hydraulic lifts will be provided for passengers in addition to the usual stairways.

It is hardly necessary to say that here, as in the City and South London line, electrical locomotion will be used, and consequently we may rely on the atmosphere in the tunnels being comparatively pure, although it is not proposed to provide any artificial means of ventilation. The whole of the journey of six and a half miles will be accomplished in twenty-five minutes, while that from Oxford Circus to the Bank will be performed in ten minutes, a rate of speed some thirty per cent. higher than that attained on the Metropolitan Railway, and comparing very favourably with the omnibuses, which now take about three times as long to travel the same distance.

The construction of a work of this character will necessarily occupy considerable time, and although it has been estimated that only two years will be required for this purpose, the previous experience of large engineering undertakings indicates that it is probable a further length of time will be needed before the railway is available for passenger traffic. The nature of the work, however, admits of its being carried on simultaneously at various points along the route by sinking vertical shafts about a mile apart to the level of the line, and afterwards driving the tunnels from the bottom of these in both directions. By this method of construction very little interference would be caused with the traffic along the streets under which the railway passes, and only at the shafts would it be possible to discover that hundreds of men were busily at work, far below the surface of the ground, in forming the tunnels for the new line.

The space at our disposal will not permit us to deal with the many other interesting features of Underground London, although the new railway which is now being made from Waterloo to the central part of the City deserves more than a passing notice. This line, after running under the Thames, emerges near Blackfriars, and here passes beneath the present underground railway, which, it will be remembered, is itself just here below the London, Chatham, and Dover Line.

At the present time there are practically no difficulties which the engineer considers insurmountable, provided sufficient time and means are placed at his disposal. It is only, however, by the co-operation of hundreds and perhaps thousands of willing hands that these great achievements are successfully accomplished, and it must not be thought that such depend for their existence solely upon one individual, however capable he may be. Only by the combined efforts of all, from highest to lowest, are we able to carry out those great works which contribute so materially to our own comfort and national welfare.

AN ELECTRIC SPARK.*

CHAPTER XXVIII.—TEMPTER AND TEMPTRESS.

WHAT to do?

Paul Wynyan's constant question which he could not answer.

'I want your clear, calm judgment, old man,' he said to himself, as he adjured the memory of his old employer, for his brain was torn by conflicting emotions. Rage against Brant; bitterness for Rénée, who was not worthy of his love; desire to rehabilitate his character, and let her see that even if reviled, he was the honourable gentleman she might have loved.

But how to shape his actions—that was the task.

Brant, he felt, must be the culprit; but he could not openly accuse him. No: his disposition was rather to screen him for Rénée's sake.

Something, he felt, must be done, or the grand old business of Robert Dalton might become bankrupt, smirched with the brand of dishonourable dealing; and the hours went by, and Paul Wynyan had done nothing.

By degrees, though, he had calmed down to one definite purpose: to do everything possible to save the Dalton business for Rénée's sake—for the allegiance he owed to his old chief.

His musings were interrupted by a messenger with a letter marked 'immediate' and sealed with the arms of the presidency of Deconcagua.

He opened it and read that the Count Villar Endoza would esteem it a personal favour if Mr Paul Wynyan would favour him with a call upon important business at his earliest convenience.

Wynyan obeyed his first impulse to say that he would come on at once.

'What does he want?' he said to himself, as soon as he was alone. 'Some fresh scheme, or a renewal of his offer about the engineership in connection with their navy?'

'No: I can't go. My work is here. It would be like showing myself as a coward and thief. She would think I ran away to avoid the exposure, and look upon me with greater con-

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tempt than ever. Let him make what offer he likes, my place is here.'

At that moment a light seemed to flash through his brain, and he recalled the count's former offer.

'Surely'—— he began aloud; but the light was gone, and the thick darkness of ignorance had closed in once more.

'Impossible!' he muttered with a half laugh. 'A strange coincidence—that is all. Pity though that I could not go. One might get the yellow fever and be put out of one's misery for good. Well, anything for an hour's rest. Perhaps I may think more clearly after seeing him.'

He reached the Count's flat in Victoria Street within half-an-hour of the messenger's return, and was respectfully shown into the drawing-room to be warmly welcomed by Isabel, who rose from her chair where she was making believe to paint in water colours. She advanced toward him with extended hand, and with a tone of reproach in her voice, a saddened look in her eyes.

'What have I done to offend you, Mr Wynyan?' she said softly. 'I never see you now.'

'Well,' he said, trying to talk lightly and pleasantly to the gaudy little tropic butterfly, as he mentally called her. 'What can you expect from such a busy, patient drudge as I am.'

'But you should not be a busy, patient drudge,' she said with a sigh, as she fixed her large dark eyes upon him timidly. 'Papa says that if you liked, you could occupy such a splendid position; that the world is open to a man of your genius.'

'A man of my genius!' he said with a laugh.

'Don't, please,' she said plaintively. 'You hurt me.'

'I? How?'

'By speaking so mockingly of yourself.'

'Then I'll begin to praise myself,' he said.

'No, please don't do that, Mr Wynyan,' she said with another shrinking look, 'for that would hurt me more, because I should know that it would not be sincere.'

'Then what am I to say?' he cried.

'Only talk to me as you used—in that quiet grave way I always liked so much.'

'Indeed?'

'Yes: people I see,' she went on naïvely, 'are so fond of talking nonsense and silly flattery, till I feel disgusted and hate them. Of course I know I am a little bit pretty; but I can't help that, Mr Wynyan, and I don't want to be told that I am the most beautiful girl in London. Just as if I was so weak and had no common sense.'

The tears stood in her eyes for part of the time she was speaking, but she finished with an indignant flash.

'Well, a great deal of the society talk is rather vapid,' he said quietly.

'Yes: isn't it?' cried Isabel. 'You never talk to me like that. What you say always sounds sincere.'

'I hope so,' replied Wynyan; 'so let me be sincere now, and talk about business. Your father sent for me.'

'Yes: I know,' she said with a little pout, 'or else you would not have come. He has a gentleman with him for a few minutes, and he asked me to see you till he was at liberty. I'm sorry I am so dull and stupid.'

'Didn't you say you wished me to be sincere?'

'Oh yes, please,' she cried, with an eager flash of the eyes; and her hand moved toward him, but only to be drawn back, and a look of confusion overspread her features.

'I will, then,' he said quietly, 'and tell you that I don't believe you.'

'Oh! Mr Wynyan! What do you mean?'

'I don't believe you think yourself dull and stupid.'

'Ah,' she cried, with an arch look, 'you are scolding me; please go on.'

Wynyan did not go on, for he was conscious of the movement in the great curtain which screened a door; and the Count entered, bland, handsome, and courtly.

'This is very good of you, Mr Wynyan,' he said. 'How I do admire the prompt way of you English business men! I do not wonder that you rule the world.'

'Promptitude is a matter of habit, sir,' said Wynyan, who resented the effusive complimentary manner.

'One I never could acquire, my dear sir. Isabel, my darling, may I ask you to leave us? I have very important business to discuss with Mr Wynyan.'

'Oh yes, papa dearest,' she said, innocently raising her lips to his. 'Good-bye then, Mr Wynyan. Come and see us soon—in the evening, when papa does not want to talk business. He ought to come, ought he not, papa?'

'If Mr Wynyan can spare the time, no one will be more glad than I.'

'Then you will come, Mr Wynyan?' she cried with girlish eagerness, as she held out her hand, over which the engineer bent for a moment, and then waited as the graceful little figure glided over the soft carpet, passed behind the great curtain, and was gone.

'My little flower,' sighed the Count to himself, as his eyes followed his child. Then he seemed to drive away his paternal weakness, and faced his guest.

'Thank you for coming, Mr Wynyan,' he said, speaking now blandly, but with a good deal of decision. 'May I ask whether you divine the reason for my note?'

'Certainly. I can only place one interpretation upon it, sir. You are ready to renew the offer you formerly made to me.'

'That is correct, sir. And you, Mr Wynyan, you have well thought over the matter, and are ready to accept?'

'I do not say so,' replied Wynyan, gazing at the handsome courtly face before him fixedly.

'But you will before you go, Mr Wynyan, I sincerely hope. I received a despatch yesterday, urging me to come to such an arrangement at once, and—well, I like you, Mr Wynyan; I always have liked you, and I will be perfectly frank with you and undiplomatic; I place myself, sir, in your hands. Make your own terms.'

Wynyan still sat gazing at him fixedly.

'Do not be afraid, my dear sir. I think I can manage to endorse your proposal. Your position will be princely, and I tell you this, my dear Wynyan: I fully expect to return soon to the dear old country with my darling child, and when I am back I shall only be too glad to welcome you to my house as one of our warmest friends—you understand; one of our warmest friends.'

'I thank you, sir,' said Wynyan, still gazing at him.

'My dearest Isabel would be delighted. I told her, dear child, and in her girlish enthusiasm, she clapped her little hands with joy. Mr Wynyan, you ought to be a happy man. Come, sir; let me despatch a telegram to-night to my president, to announce that we shall in future have with us one of the most skilful engineers in England, who is at the same time one of my dearest friends.'

'One moment, sir. Kindly tell me what would be expected of me if I accepted this appointment.'

'Of course; I ought to have been more explicit,' said the Count. 'Forgive me. To help us by making our little navy one of the most powerful in the world.'

'By means of a new motive power?' said Wynyan quietly.

'Exactly.'

'What motive power?' said Wynyan; and the Count was silent for a few moments, meeting his visitor's gaze with an equally searching look.

'I will be frank with you, Mr Wynyan,' he said at last. 'It is a secret power—a new invention.'

'Whose, sir?'

'That I am not prepared to say, Mr Wynyan; and it does not affect our arrangement in the least.'

'I beg your pardon, sir.'

'Very well then, I am speaking in confidence, to a man of honour. I cannot tell you whose invention it is, but the right to use it—the secret of the invention—was sold to my government some little time back, and we are now waiting to carry it out.'

'I thought so,' said Wynyan sternly. 'Are you aware, sir, that your government has connived at a theft; that the purchase of this secret was part of a base, disgraceful, dishonourable action?'

'Mr Wynyan!' cried the Count, drawing himself up.

'Yes, sir; I am speaking plainly, for I feel warmly on the subject. I see now clearly enough that which my nature as that of an honest man would not have insulted another—especially my old employer's friend and guest—by believing true.'

'Mr Wynyan, what are you saying, sir?'

'This,' cried Wynyan sternly, 'that you, sir, have taken advantage of your position as the trusted friend of Robert Dalton, to gain possession of one of his most cherished secrets.'

'You are talking wildly, sir,' cried the Count.

'No; calmly and to the point. How you have worked I do not know. I cannot think that Robert Dalton would have confided in you—he would not, I am sure. There has been some miserable underhanded scheming, and you must have been mining with a tool which I suspect; but as I cannot say for certain, I will be silent and make no further charge.'

'I am glad to hear it, Mr Wynyan,' said the Count with dignity. 'You have said enough.'

'No, sir; not enough,' cried Wynyan, 'for I do charge you of having been guilty of a piece of chicanery which'——

'Sir!' cried the Count, 'I do not accept that I have done this. If I had, I have been fighting as in duty bound, in a patriotic way, for the good of my great country. As a patriot'——

'Patriot!' cried Wynyan, interrupting in his turn. 'Sir, there is no word in our language more scandalously abused than that word patriot. An adventurer fights at any cost to win pelf and success for himself, and he calls it patriotism. We have plenty of so-called patriots here, sir, but none who have been guilty of a more scoundrelly trick than yours in this theft.'

'Mr Wynyan!' cried the Count, 'in my country this would mean a meeting, possibly, sir, your death.'

'But in this country, sir, but for the fact that your position screens you, your action would probably mean the police and a visit to a court of justice.'

'I will not quarrel, sir,' said the Count sternly.

'No, we cannot quarrel,' cried Wynyan; 'but you shall hear the truth. You may, or you may not be aware that you have been tempting me to carry out my own invention for the benefit of your people, and in opposition to my own government, the rightful owners of the secret.'

'Mr Wynyan!'

'Silence, sir. You shall hear me now. Let me tell you what your dishonest act—your patriotism—entails. You will not win me over to your side, even if you have learned that I stand in a position which made me likely to be tempted.'

'Pray, go on,' said the Count coldly.

'I intend to, sir, as a stubborn Englishman should. Now listen. You and yours will reap no advantage from your purchase—for purchase it must have been—for it is a secret, and there is only one man living who can carry out the plans to success.'

'And you are that man,' said the Count with an almost imperceptible sneer.

'Yes, sir; for years I lived in the invention of that motor, and I tell you the truth; I am the only man who can carry it out to success. Lastly, let me tell you this: our government has discovered by some means that the secret has been stolen. They must know that it has been taken to Deconcagua, and they have begun their inquiries as to the way in which they have been defrauded. Are you prepared to answer them? You are a nobleman, the representative of your republic.'

The Count was silent.

'In case they do not know, sir, let me tell you this: I have been charged with the theft of the plans, with selling them; and I am

seeking to clear my name. To-morrow I go straight to the government officials, and I tell them everything I know.'

'To clear your good name?' said the Count quickly.

'Yes.'

'What, then, if I play my card as well, Mr Wynyan?'

'This is England, sir. You cannot play Spanish American tricks here without risking our gallows,' cried Wynyan proudly.

'Assassination?' said Endoza with a contemptuous laugh. 'Oh no, my dear sir, I am a diplomat. I shall play a very different card, what you call the trump ace. Go and tell your officials—you, the employé of Dalton's firm, that I bought the rights in the invention. I, the accredited gentleman, will simply say yes, it is quite true; I did buy these plans—this secret—for my country in ignorance that there was anything wrong, for the inventor offered them to me.'

'Mr Dalton—the dead?' cried Wynyan, staggered.

'No, sir; Mr Wynyan the quick—I bought them of you.'

There was a dead silence after this blow had been delivered.

'You cowardly liar!' cried the young man at last.

'Diplomacy, Mr Wynyan,' said Endoza calmly. 'You have your reputation to save; I have mine. Come, sir, we have fenced enough. Had we not better sheathe our swords, and become friends. I renew my offer to you, even to my daughter's hand.'

'Sir,' said Wynyan bitterly, 'you know our language thoroughly, but of the sturdy English character you have much to learn. English credit stands good the world round. We have exceptions, I own, but we have such a being in my country as an honest man.'

'Stop one moment, Mr Wynyan. Do you mean you would say war.'

'As you would say, sir,' replied Wynyan, 'to the knife.'

The next minute the Count was standing, with his brow knit in many creases, alone.

'Yes,' he said at last; 'that will be the best. Cold-blooded dog!'

(To be continued.)

THE RISE AND FALL IN PETROLEUM.

It has long been an axiom in commercial circles that, when trade was good, prices were high, and when trade was bad, prices were low. Doubtless, one of the compensating benefits of bad trade has been the low price of all necessaries. Moreover, every one must have noticed the strong tendency of every commodity to fall; improvements and increased facilities in transport from all parts of the world, combined with cheapened production, have enormously lowered the value of everything compared with values ten years ago. Some articles indeed seemed to have no bottom; their value fell below the actual cost of production. Petroleum has been no exception to this rule, as it has been steadily falling in value for years. When, therefore, this product some months ago suddenly marked an extraordinary rise in value, and continued within the space of a week to double and treble this rise, such an unprecedented state of affairs occasioned a wave of excitement in the mercantile world, and an immense amount of speculation as to its cause and effect. The probability of an oil famine became a serious subject of discussion, and no wonder, when it is considered that mineral oil is largely used for illuminating purposes, and required in almost every industry that can be named as an important constituent in lubricating oils, and for other purposes too numerous to mention. On one British industry the effect was immediate and most welcome. For some years past the Scottish mineral oil trade has been in a very languishing condition, and the relief has but just come in time.

No trade has had a more checkered career, or has oftener appeared on the point of extinction, but some ingenious discovery in the utilisation of a by-product has always appeared to save it, and give it a new lease of life. Paraffin oil for burning was the original object of manufacture, but for many years the by-products have alone been earning a profit. The statement early in the year that the Standard Oil Company, which mainly controls the oil trade in America, had come to an arrangement with the Scottish companies to advance the price, would now appear to be part of a scheme to anticipate the rise which the former saw was bound to take place, due to a cause which even it could not influence, namely, lessened production by the oil-wells. An agreement of the Standard Oil Company with the proprietors of the Russian oil-fields, reported, but subsequently denied, was regarded as in the same interest.

The annual report of one of the principal Scottish oil companies says: 'The position and outlook of the trade are now more favourable than they have been for a lengthened period. An agreement for three years has been concluded between the Standard Oil Company of America and the refining companies in Scotland, by which the prices of scale and candles have been advanced; and, consequent upon the greatly diminished production of crude petroleum, an increase has taken place in the prices of burning oil and kindred products.'

Though an inconvenience to the consumer, a moderate rise in the price of mineral oil is of very little importance compared with a large permanent increase in price, which is a very serious contingency to have to face. It is the possibility of this which has agitated the public mind and rendered the situation interesting. From all accounts it appears certain that the Pennsylvania oil territory has become much less productive than it

used to be. The explanation of the Standard Oil Company is to the effect that the consumption of petroleum is at least 10,000 barrels a day in excess of the output. Now, in America, oil is sold in what are called Pipe-line Certificates, and while there used always to be outstanding certificates for 40,000,000 barrels of oil, these have been reduced to about 4,000,000. An independent authority says that in the past two years the stock of oil has fallen off from 18,000,000 barrels to about 4,500,000, and that at present oil production is 5,000,000 to 6,000,000 barrels a month behind consumption; so that it is plain that at the present rate, if no big oil strikes are made, it is only a question of time until the stock on hand in the United States is consumed. The Standard Oil Company is said to have lately expended about 2,000,000 dollars for oil rights in Pennsylvania and West Virginia in anticipation of the scarcity. 'Wild-catting'—that is, prospecting in territory not known to be oil-bearing—is immensely in favour, we are told, and it is to be hoped will soon yield a plentiful result.

Two years previous to January 1895, the price of oil was fifty-three cents per barrel; in January it had risen to one dollar, while less than four months later it touched two dollars.

Owing to a peculiar policy of the American oil trade, until recently the price of refined oil has been lower than crude oil; but this condition has now experienced a sharp reversal, and during the first quarter of the year, refined quality rose from $5.70 to $7.10, while during the same period crude oil has advanced from six to seven dollars. Petroleum statistics from other centres all tell the same tale.

Next to these oil-fields, one of the most important is that of Ohio. For illuminating purposes this oil is not nearly so suitable as that of Pennsylvania; it resembles the Russian oils in this respect, that there is a considerable waste in refining it, though some of the waste can be utilised for making lubricants and for fuel. Crude oil from the Ohio region is said to yield only thirty-three per cent. of illuminating fluid, as against nearly ninety per cent. from Pennsylvania; but the Ohio refined oil is nearly as good as the Pennsylvanian.

Naturally, the oil territory is being prospected to an extraordinary extent in the endeavour to increase production, while something like one thousand five hundred new pipe-wells have been sunk, a number constantly increasing. Oil-wells which had been abandoned as unprofitable have been reopened, and every means taken, such as the explosion of dynamite in the shafts, to stimulate the flow.

The view that has so far been here presented is that a permanent rise in the value of this indispensable commodity has been established, but it is right to state that some people do not hold this opinion; they consider that a combination of the interests controlling the supply is chiefly responsible for the advance in petroleum, and the scare over for the time being, they are doing their best to test the question, though time only can solve it. The highest price paid for American refined was 9½d. per gallon; a month previously this had been 5½d.; Russian oil, which had been less than 5d., went up to 9d. quite as rapidly. These values have not been sustained; the trade held aloof, and the price of American oil went back to 7d. per gallon, and of Russian to 6¾d.—about 2½d. below the highest recorded. In September the price both of American and of Russian petroleum 'on the spot' was 5½d.

Another feature of the situation to be considered is, that in America the consumption of oil as a fuel and heat generator has been making great strides, and that, given a reasonable price, it possesses some very great advantages over other fuel. Its efficiency is specially great in heating furnaces, forges, puddling furnaces, and in boilers of all kinds; and that the combustion is much more perfect than coal is shown by an almost total absence of smoke.

Other applications are in glass-works, potteries, ovens, dryers, refuse destructors, and many other industries. Less attendance is required, it is far more cleanly in the way of dust and dirt, and less expensive in the matter of repairs. As compared with coal, about one hundred and ten gallons of crude oil will do the work of a ton of the best coal, and there is no reason to think that finality has been reached in this result.

As is well known, one of the causes of the hitherto cheap price of petroleum has been its successful conveyance in bulk by means of tank steamers. One of the most conspicuously successful examples of the experiment of using petroleum residuum as fuel in the furnaces of marine boilers has been a voyage of the s.s. *Baku Standard*. This tank steamer had her furnaces altered, to enable them to burn liquid fuel instead of coal; thus adjusted, she steamed from the Tyne to Philadelphia, meeting with heavy weather all the way. Her consumption of fuel is said to have been twenty tons of oil instead of thirty tons of coal, and it is claimed that besides the advantage of much greater cleanliness, a considerable saving in space and cost of fuel was obtained. Probably there is yet required a good deal of further information before an exact comparison can be made, but at any rate, here we have a case of a vessel that has steamed across the Atlantic and back, using oil fuel only. The time taken on the homeward run to Avonmouth, namely fourteen days, is not unduly long for a small-powered steamer in bad weather. The substitution of oil for coal in steamships, if ever it came about, would be a wonderful improvement, and one that would confer untold benefits on marine firemen. But the applications of mineral oil are endless in possibility, provided it continue cheap enough.

Allusion has been made to the Russian petroleum trade; this is of much later growth than the American. Russian petroleum only began to enter the British market in large quantities ten years ago. The oil-fields of Baku are by far the most productive known, and since 1883 (practically, operations on any important scale only commenced in 1872) the production has undergone enormous expansion, rising from five

and a half million barrels in 1883 to over twenty million barrels in 1890. It has been stated on good authority that of the four hundred wells open in the Baku fields in 1883, one has thrown up as much oil in one day as the whole of the twenty-five thousand oil-wells of America. In another case, over £11,000 worth of oil has run to waste in one day from a single well. There is therefore good reason to believe that Russian oil can easily supply the deficiency caused by a considerable falling off in the supply of American petroleum, although it must be borne in mind that Russian crude oil only yields thirty per cent. of refined, as against ninety per cent. in the case of America. The Russian trade is largely in the hands of Messrs Nobel Brothers, who occupy a position much in the same relation to this industry as does the Standard Oil Company in America. That there are probably immense undiscovered oil deposits in Siberia is partly confirmed by the recent discovery of naphtha springs in the Transbaikal region. In the Amur Valley, these promise so satisfactorily that a syndicate of Russian capitalists has been formed, and has applied for permission to the authorities to be allowed to exploit the territory on a large scale. Oil-fields of some importance exist in Java and Sumatra, and there are several Dutch companies established in these islands, which possess wells varying in depth from 75 to 1850 feet. The Java petroleum yields a large proportion of valuable by-products, such as lubricating oils; the Sumatra oil produces more kerosene and less paraffin.

There are other petroleum fields in the east of Europe and in Asia, that of the Bolika district in Galicia yielding three hundred and fifty barrels of raw petroleum per day in 1883. Mineral wax is found at Boryslav, on the north slope of the Carpathians. The petroleum fields of Roumania are hopeful. In Japan, the petroleum fields were worked at one time, but latterly, owing to the competition of American oil, the industry is said to have been abandoned. Whether the increased value of oil will now make it worth while to reopen and develop these Japanese oil-fields is, however, a doubtful question. One of these days, too, the virgin oil territory in Canada and India will be tapped, so that a decreasing supply from Pennsylvania may be faced with something like equanimity. The petroleum basin of the Mackenzie River is reported as one of the richest in the world; but its distance, four hundred miles north of the Canadian Pacific Railway, has been against its exploitation hitherto.

An extremely interesting problem awaits us much nearer home, and that is, are there oil-fields in England? Since petroleum has been found in many different strata, there is no *a priori* reason why it should not be found in England. Professor Boverton Redwood is sanguine on the point, and after having made as exhaustive an investigation on the Ashwick estate in Somersetshire as circumstances permitted, reports that appearances strongly favour the existence of petroleum in large deposits, and at any rate in quite sufficient quantity to warrant provisional expenditure for boring. On the recommendation of Professor Redwood and other scientific advice, dynamite was used in the spring, with the result that the water came up thickly coated with oil. The official report is that the specimens of oil obtained were transparent, of straw colour, exhibited practically no fluorescence, and had an odour resembling that of refined rather than crude oil. It had a specific gravity of ·816 at 60° Fahrenheit, and a flashing-point of 175° Fahrenheit by the closed test. In other words, here is a high-class oil, which should require very little process of refining to render it able to compete with some of the best products in the market on terms of equality.

From the foregoing, it is pretty apparent that we need not fear any oil famine in the near future.

AN ADVENTUROUS WEEK.

CHAPTER IV.—CONCLUSION.

It was noon when our flight ended in a gray, faded settlement, girdled by cliffs save where we had come upon it, and where a narrow defile led from it down to the coast. The church-bell was jingling for some unapparent reason as we reached the dishevelled building itself.

We were soon surrounded by the villagers, agape for intelligence. They received the news of the patriots' reverse in silence—at least the men did; the women wept.

Happily, there was an apothecary here. We conveyed Naylor to his house, prepared to hear the worst, for the poor fellow's face told its own tale.

The man wore horn spectacles that gave him an owl-like look. His tedious pedantry was also suggestive of the owl's sham demeanour of exceeding wisdom. De Blessant was worth two of him as a medical man. But neither of them, nor all the physicians in the world, could give Naylor his life-blood again.

'Do stop them bothering about me, old fellow,' he whispered at length. 'I know I'm booked.'

I said what I could to persuade him to think otherwise, and told him we were within a mile or two of the port in which the *Panhellenion* lay.

'Once we get you on board, you'll do,' I said, hoping against hope.

The mention of the steamer seemed to brighten him.

'Are you sure you can get to her?' he asked.

The apothecary laughed to scorn the idea that one little defeat in the mountains meant the collapse of the insurrection. According to him, it was rather the very thing that was most wanted to make the Christians fight their best. No Turk would dare from the north to invade the southern ravines of the Madara Vouna; and that was the only direction open to them.

'Then there's one thing you can do for me,' Naylor continued, speaking with more and more difficulty as the internal bleeding progressed.

'Whatever it is, I'll do it,' I said.

'My notes—take them with you. You'll be returning to England?'

'As soon as I can—with you.'

He shook his head, smiling again. He knew better than that.

'Made on the spot, you know, they have value,' he murmured. 'You promise?'

I told him I would try to do something more arduous than that if he wished it.

'There's nothing else,' he replied. 'I'm just a straw in the wind: no wife, brother, sister, or any one. Thank God for it, too!'

We could do nothing but watch over him to the last. There were moments when I should have enjoyed the excitement of defending the apothecary's house against attack: this patient waiting for the end of a bold, reckless life was so miserable. But no such chance offered. The village was still as the grave, except when the cracked church-bell jangled periodically, and that was worse than the brooding silence.

Once he rallied De Blessant about his inadequacy as a prophet.

'Oh, but, *mon cher garçon*,' retorted the Frenchmen, 'who knows? I may follow you soon. I shall revenge you, for one thing. Give me a death like yours a thousand times sooner than on my feather-bed in Paris.'

To which poor Naylor replied almost inaudibly, with a painful attempt to laugh: 'Bunkum, my dear fellow!'

Towards eight o'clock he breathed his last, making me feel wretchedly alone. Though I had known him but a few days, I had learned to love him as a friend. Almost his last words were an injunction to us not to bother ourselves with his body. The Sphakia churchyard, he said, was good enough for him, if it was good enough for the Sphakiots.

And that was what we did with him the following morning. There were graves ready dug in the churchyard—ominous sign!—and in one of them (which the sun shone on more than on the others) we laid him, in the presence of all the village, including several other patriot refugees from Thyatis's army.

What had become of the bulk of our fighting friends we did not learn until that afternoon. Then we made our way to the coast and, under guidance, skirted the tremendous spurs of the Madara Vouna until we reached the snug creek in which the *Panhellenion* lay like a nut in its kernel. Here the confusion was bewildering. The patriots made bright patches of colour in the cramped place, and their chatter and declamations raised echoes for the mountain walls to toy with and cast out (so one fancied) almost to the lazy cruisers in the offing. Some two hundred of them were believed to have been killed; and, worse still, the wounded had had to be left. Under the circumstances, it seemed small consolation that more Moslems than Christians had come to their end in the affray.

Thyatis was not here when we arrived. But he was looked for every moment. Pending his and the other leaders' coming, the captain of the *Panhellenion* could say nothing about his return (or attempted return, as might be) to the Ægean. He had already disembarked the cargo of arms, ammunition, and provisions sent by the insurrectionary agents in Athens, and had ballasted the boat in readiness for his next trip at an hour or two's notice.

De Blessant got his letters.

'I stay here,' he repeated, when I asked him if they made him alter his plans. 'I am like *le bon Naylor;* there is no one except *la petite* to whom I report myself, and she will excuse.'

He was not to be dissuaded. It was the first defeat with which he had been associated in Crete, and his French blood thirsted to avenge it. So he said, and his gallant looks bore out his words. The Sphakiots could have done with a hundred men like him; and so, perhaps, could Crete.

As for me, I was very uncomfortable. The old business instincts were fidgeting in me. I was wronging my partner and all who depended on us by this misapplication of my time. Moreover (and chiefly, I daresay), I had had quite enough of war, especially this guerilla warfare in the mountains. My legs were stiff as an old man's with their unwonted exercise.

The captain of the *Panhellenion* could speak a moderate amount of English, and was disposed to be friendly. I was, he said, welcome to sleep on the steamer, so that I might not miss the chance of getting to Greece, whenever that presented itself. But he warned me of the new danger I was facing in thus getting aboard a vessel that would be blown to bits by the first Turkish gunboat that got the opportunity. Of this, however, I took small heed. Merely on the balance of risks, the *Panhellenion* was the thing for me. And besides, from the twinkle in the captain's eye, I surmised that the patriot ship was not to be overtaken by any ordinary cruiser of the Sultan's fleet.

The rest of that day was spent amid the babble of the insurgents. De Blessant and I both agreed that they were even better at talking than fighting. But they need not have quarrelled among themselves as they did. This seemed to be the worst portent of all as to the final issue of the revolt.

Thyatis was expected hourly, but he did not show until the next day. Then he appeared, haggard, fierce, with a bandaged arm, and a 'do-or-die' demeanour that was not encouraging. The Turks had so far been content to establish themselves securely in two of the blockhouses. Their aim, he said, was to get some light artillery up from the plain. Until that was done, they would not venture on aggressive movements to the south.

So far well.

This news, and the knowledge that there were still thousands of fighting Sphakiots left, restored the spirits of the warriors by the sea-board. Whatever else had happened to Thyatis, he had not lost energy, and in a few hours his influence invigorated the tone of the place. The *Panhellenion's* cargo was very welcome, and the letters from Athens about future supplies were also favourable.

As the upshot, it was decided that, weather

and the situation of the cruisers permitting, the *Panhellenion* should be off that night. And so I prepared to look my last at Crete—if not for ever, at least for a very long time. I had, of course, resisted Thyatis's warm invitation to continue with him and his men. Even for the moral encouragement's sake, I did not think it worth while to offer myself as a sacrifice to the Sphakists, like poor Naylor.

The cruisers somehow seemed to have got an inkling of what was in the wind. As the day waned they stood closer inshore than hitherto, and, either for pastime or a menace, fired big guns landwards. Probably the victorious Moslems above had found a means of signalling their news to them, and this had momentarily inspirited the lethargic admiral who was in charge of the blockade.

'It is nothing,' said Thyatis, with a contemptuous upheaval of his nostrils, when I mentioned the firing, and hoped it did not imply increased vigilance. 'We would run under their noses, and they would not see us.'

But I was not so sure. The highlander's temperament was of too unreasonably sanguine a kind to fit well into what I suppose I may call my British prudence.

There was a young moon this night. The thing was pretty to see, in combination with the silvery rippling and throbbing of the Mediterranean and the stupendous dark mountain wall at our backs. But I would rather not have seen it. The young thing would grow in size and luminosity every day, and thus the loss of each opportunity of getting out of Crete would add to the probability of our not getting out of it at all.

But such thoughts were not to be encouraged. The *Panhellenion's* furnace fires were already glowing, and when the captain gave the word, it only remained for the engineers to let us loose. Eleven o'clock was the time fixed for the start. Once again my pulse began to rise as this hour drew near.

I had but to shake hands with Thyatis and De Blessant and wish them 'Godspeed' in their enterprises.

The former humiliated me by thanking me for what I had done for the cause: he did it with his old exuberance of speech and earnestness; and he ended by entreating me to try to interest the British Government on the patriots' behalf. I made no rash promises.

'Adieu, *mon ami, et bon voyage*,' said De Blessant, when we had drunk to each other; 'we shall meet in Paris some day, and you shall see me *décoré* by the Cretan Republic.'

'Yes,' added Thyatis, 'that will be it—remember.'

I am still remembering. But there is no Cretan Republic, and therefore no decoration for Gaston de Blessant, whom besides I have not seen since. He may be dead, like Naylor; or he may be the sage, corpulent father of two well-grown children, and the husband of a discreet wife in the Chaussée d'Antin or elsewhere, for all I know to the contrary. The enthusiasms of youth die with one's youth: very properly, no doubt.

We were on the point of starting, when there was a cry to stop. A little boat pushed off, with three men in it and two rowers. Our passenger list was to be increased by these three. I watched them come aboard, and suddenly my heart became agitated as I recognised the venerable beard of Nicolopoulos. Yes, it was he, unmistakably. I went up to him, held out my hand, and said I was glad to see him. But I was really nothing of the kind. It would have been very different had his daughter been with him. Alone, however, bound for Athens at such a time, and that beautiful girl left by herself in a land like Crete!

He said 'Good-evening' in Greek mechanically, as he just touched my palm.

The *Panhellenion* began to move. There were subdued shouts of goodwill towards us, as we stole darkly towards the rocky mouth of our haven. Not a light was allowed on board to give the least hint of us to the cruisers.

Nicolopoulos was about to lose himself in the throng on deck, when I checked him. I was impressed by a sort of hang-dog expression on his face seen in the starlight. Also, I was sure he had not recognised me.

'Forgive me,' I said, 'but has anything happened?'

Now he seemed to realise that it was English, not Greek, that was spoken. He looked at me. I do not want to see a look like that again on any man's face.

'Oh,' he said hesitatingly, with a bitter smile, 'it is you, Mr Graham. So we are to be fellow-passengers! It is well.'

'What is wrong?' I urged. 'Is *anything* the matter?'

'The matter! Yes, much, sir. They have taken my daughter from me. She is condemned. She is a leper, like her mother. Gracious Heaven! I knew it was in her; but I loved her so much. The demons! It is because I hate the Government. That is what is the matter, Mr Graham. I wish to see the captain.'

Helena a leper, and cast out into that settlement of pitiable misery, that place of horror! Nicolopoulos's words seemed to blast me as her seizure must have blasted him. I sat on a heap of rope, and could think of nothing else as we sped rapidly along, hugging the shore, with hardly a whisper on board.

. . . . . .

I did not go to bed that night. Somehow, too, I did not feel as glad as I ought to have felt when the captain came among us and told me, as well as the rest, that the worst risks were over. It must have been two o'clock in the morning then.

With Nicolopoulos I did not exchange another word. What could I say? But I felt for him, deeply, unforgetably.

We reached Athens in the evening, and all was well. A week later I was in London, considerably browner than when I had left Victoria Station some five weeks earlier, and considerably more experienced.

A few dried rose-leaves are now all the visible remembrances I possess of my stirring week in beautiful, and still unhappy, Crete.

I fulfilled poor Naylor's request. His 'copy' was printed and read; but it would have been better appreciated if the readers could have

known him as I had. After all, perhaps, he was not greatly to be pitied. He might have died in a worse cause than that of Cretan freedom; hit in front, too.

THE MONTH:

SCIENCE AND ARTS.

THE annual meeting of the British Association has always been looked forward to with interest, not only by those who take part in its proceedings, but by the general public who like to have this periodical report of the world's progress in the field of scientific knowledge. Perhaps these meetings are not regarded in quite the same light as they were a few years ago, for now the proceedings are to a great extent anticipated by statements in the technical press, and even in the general newspapers. For a scientific man admits every one to his confidence, and no matter what the importance of a discovery may be, it is given as freely and quickly to the world as if it were a mere piece of gossip. In matters of first importance, the British Association is also anticipated by the learned societies before which papers are read, which, so to speak, take all the cream. Still the Association does useful work, and provides an annual outing for a number of ladies and gentlemen who are interested in its proceedings. More than this, it spends about £1000 annually in the great cause of original research, and has put away a handsome reserve fund in case of need.

The Association met this year at Ipswich for the second time, after an interval of forty-four years. It is noteworthy that on the former occasion the meeting numbered amongst its members Tyndall, Huxley, Murchison, Owen, and Nasmyth, besides other names which have become famous. Ipswich has since the year 1851 nearly doubled its population, and naturally, when Sir Douglas Galton took the chair the other day as president, he addressed a far larger audience than did Sir George Airy on the previous occasion. The subjects dealt with were of the most varied nature, and, generally speaking, the meeting of the British Association this year has been a success.

The subject of motor-propelled carriages (see *Chambers's Journal*, No. 610, Sept. 7, 1895) is just now exciting great interest, and there is little doubt that a new and important industry is springing up in their manufacture. Sir David Salomons, who is a skilled electrician, has recently been describing in glowing terms the different vehicles of this type which he had had an opportunity of examining in Paris. One of them was a tricycle driven by a tiny petroleum motor, weighing ninety pounds, and costing £52. 'In order,' he says, 'to set the machine in motion, the rider mounts, turns a tap to admit the petroleum, which at the same time turns on the electric current (this is to furnish the spark to ignite the petroleum vapour); he then propels the tricycle with his feet in the usual manner, until he finds that the motor is working. Another handle releases the treadles, and the tricycle is then in full swing. On mounting a hill, the rider can assist the speed by gearing up the pedals again, and using the feet, thus adding the animal to the engine power.' There are also being constructed a chaise, Victoria, phaeton, &c., at prices varying from £350 to £500. Nor must we omit to mention the 'steam-horse' which can be joined to an ordinary carriage instead of bone and muscle.

Mr G. J. Symons, F.R.S., the celebrated meteorologist, has lately been 'interviewed,' and as a result, some very interesting particulars relative to his work have found their way into print. Mr Symons describes himself as a collector and compiler of the observations of others, for he is in correspondence with no fewer than three thousand voluntary workers scattered over the United Kingdom, who transmit to him at regular intervals records of rainfall in their particular localities. These records are of the greatest value, for the whole science of hydrology depends upon them. Our supply of water, the first requisite of existence, depends upon the rainfall, for rivers and springs are fed from the clouds. When any question therefore arises relative to water supply, the records furnished by Mr Symons through his three thousand coadjutors to the meteorological office are first of all consulted. The daily reading of the rain-gauge found in the grounds of many a country-house and rectory through the kingdom is considered a pleasant duty, and is none the less valuable because voluntarily performed.

The railway companies have lately once more proved their ability to cover the distance between London and Aberdeen in a remarkably short time, but all will feel relieved that the 'race to the North' has been a mere demonstration of what steam on good roads can do. Prudent people consider the excessive pace attained to be unsafe, and many experience something akin to sea-sickness as a result of the excessive vibration. Trains have since been run from London to Carlisle, a distance of three hundred miles, without a single stop, and without any undue heating of the bearings. This is a remarkable achievement. The most useful outcome of these wonderful exhibitions of power on the part of our northern railways will probably prove to be the attention which they have directed to the shortcomings of some of the other lines. Two of the southern railways have become quite notorious for their bad service, ill-equipped trains, and constant want of punctuality, and it is difficult to understand how this lamentable state of things is allowed to go on year after year without any apparent attempt at amelioration.

Some very fine photographs of the moon have lately been exhibited by MM. Lœwy and P. Pruiseux at the Academy of Sciences, Paris. The negatives have been enlarged, and copies have been sent to all the principal societies. These enlarged pictures offer great facilities in the study of the moon's surface, for every detail is shown with wonderful clearness. Each picture embraces a great expanse of surface, and it is believed that by their help many undecided points with regard to our satellite may be cleared up. The authors of these pictures

have given to the Academy some of the results at which they have arrived after studying them. They agree with Laplace's theory in believing that the great reflective power of the moon is due to its crust being of solid matter, similar to our volcanic rocks. And they then proceed to theorise upon the origin of the craters and valleys seen on its surface, suggesting hypotheses which will no doubt be contested, but which show that the photographs have raised many important questions with regard to our nearest neighbour in space.

The Isle of Man now possesses a mountain electric railway, which runs from Laxey, where the famous gigantic water-wheel is found, to the summit of Snaefell, a distance of nearly five miles. The gauge of the railway is three feet six inches, and between the rails there is a central one which is clasped by double wheels attached to the bogies of the cars. The overhead wire system has been adopted, and the current is generated by four Lancashire boilers of one hundred and fifty horse-power each, five horizontal engines of over one hundred horse-power each, and five powerful dynamos of the Mather and Platt type. The power exerted is sufficient to work three or more cars, each loaded with forty-eight passengers, the speed being about eight miles per hour. The railway has a remarkably even gradient throughout its length.

It would seem that light railways worked by electricity have a very great future before them in opening up districts which at present are cut off from our great trunk lines. For a long time such a railway has been projected between Derby and Ashbourne, in order to provide an outlet for dairy and agricultural produce from some of the richest milk-producing districts in Derbyshire. Such a railway, too, would doubtless be largely patronised by tourists to the famous Peak scenery. This scheme has lately crystallised into a proposal that the railway should be of the electric type. The cost of an ordinary railway worked by steam was estimated at from £30,000 to £50,000 per mile. An electric railway is of course very much cheaper than that, and the cost of running per car mile is 4·06d., as against 8·57d. by steam. It is proposed that the line should run by the side of the existing road between the two places, and that in the villages it should take the centre of the roadway. There would be fixed stopping-places, but the cars could stop anywhere to take up or set down passengers. It is estimated that the total cost of the line would be £62,300, and that the passenger traffic alone would realise £7500 per annum, to say nothing of the agricultural produce, for the conveyance of which the railway is primarily intended.

A most interesting letter on the effects of lightning has been sent to the *Times* by Mr Tomlinson, F.R.S., who gives in it the early history of lightning-conductors. Architects believed that they did harm by attracting the lightning, and the Admiralty seems to have shared a similar belief. In 1841 Sir John Rennie was employed by the Admiralty to build two victualling-houses at Devonport, and each of these had a tall chimney—one being protected with a lightning-conductor, and the other left bare. Rennie called on Snow Harris—the great advocate for the application of conductors to ships—and most indignantly pointed out that the charge for conductors for the chimneys had been struck out of the estimates. Harris said, 'Well, never mind, nature will avenge us.' And the words came true, for shortly afterwards a bifurcated stroke of lightning fell on the two victualling-houses; the protected buildings suffering no injury, while the unprotected chimney was torn open, with other damage to the building. The accident made lightning-conductors popular. Harris was knighted, received a civil list pension of £200 per annum, and a sum of £6000 in addition.

A new road skate has recently formed the subject of a demonstration at Celtic Park, Glasgow, upon which occasion James Smart, the champion, and two other well-known skaters gave the invention a thorough trial on the cement cycling track. Two miles were covered by Smart in seven minutes, and his action, which is much the same as when skating on ice, was much admired. The new skate is eighteen inches in length, and it runs on two rubber-tyred wheels, one behind the foot and the other in front. It is patented by Messrs Anderson & Son of Edinburgh.

At the autumn meeting of the Iron and Steel Institute a number of papers were read, most of them, from their technical character, being interesting only to those immediately concerned. Mr Wiggin's paper, however, in which he took for his subject the advantages of the comparatively new and remarkable alloy known as nickel steel, has a much wider interest, for it deals with a subject of great importance to the community at large. He opened his paper by pointing out the long-continued opposition which was made to the introduction of steel, which only ceased when improvements were introduced into the manufacture of mild steel, and greater uniformity was secured. In the same way that steel had superseded the use of wrought iron, he believed nickel steel would gradually take the place of ordinary steel. Nickel steel was now being produced with a tensile strength fully 30 per cent. higher than ordinary steel, and an elastic limit at least 75 per cent. higher. The alloy possessed remarkable uniformity, the nickel being evenly distributed throughout the ingot; and for structural purposes, as well as for boilers, ships, and artillery, it was unequalled. A terribly severe test to which this alloy was put at the ordnance works, Sweden, well demonstrated its marvellous strength. In a cast nickel-steel gun tube was placed a cast-iron shell charged with picric acid. This shell was exploded in the tube, the only result upon the tube being that it was expanded 0·07 inches. A second explosion of the same kind, in the same tube, had no further effect upon it. Successful results had also been recorded with the use of nickel-steel armour-plates for ships. This new alloy is being much employed in the United States, as well as in Germany, France, and Russia, and it is a matter for surprise that it has not made as forward a progress in our own country.

Most of us have long regarded our system of

trial by jury as an almost perfect method of obtaining even-handed justice, for the men on the jury are chosen hap-hazard, and any one of them who from any circumstance may be suspected of having a leaning towards the prisoner or prosecutor, is at once disqualified from service. It is therefore with uncomfortable feelings that we read the results of some investigations into the psychology of jurymen which Dr T. D. Crothers has recently brought before the notice of the Medico-legal Society of America. The bad air, the cramped position, and the hurried meals to which jurymen are, as a rule, subjected affect them in a marked degree. In addition to this there is a brain fatigue in following a tangled skein of evidence in a protracted or complicated case which would be in itself enough to upset a rational being; and owing to these causes some jurymen will get vindictive, some careless, and some ready to agree to anything. Should a juryman be already the victim of dyspepsia, or suffering from any nervous complaint, he is more powerfully affected still; and we fear that there is a great deal of truth in Dr Crothers's assertion that 'the psychology of a jury on a long trial furnishes a range of facts which, when once understood, might make it possible to predict a verdict with great certainty, no matter what the evidence.'

Dr Schweinfurth pleads for less vandalism in Egyptian excavations. He complains that while the searchers are attracted by everything in the shape of an inscription, statuettes, pictures, papyrus rolls, and scarabs, organic materials are lost, and often ruthlessly trodden under foot. He tells us that this ignorant and contemptuous destruction of materials of botanical and zoological investigation is depriving students of the means of solving important problems. An exact study of the bones of domestic animals, as well as those of the chase, should have been especially inviting, as it would have been possible to fix the order of appearance of each kind by means of chronologically established finds. An examination of the vegetable remains, originally placed in the tombs as offerings to the dead, or in the form of garlands of flowers, would also lead to invaluable results. At present, explorers neglect these things altogether, and Dr Schweinfurth does useful work in calling attention to the subject.

RUNGA'S REVENGE.

By Mrs Frank Penny.

It was Nellama's wedding day. The tom-toms were drumming and the panpipes were wailing their strange music through the Hindu village. The nautch-girl from the temple was there, and at intervals her voice was heard in wedding-song. Nellama was a proud and happy girl, although she looked so shy. When addressed, she dropped her chin upon her breast in decorous and speechless modesty, which was quite the right and proper thing for a Hindu maiden to do. All the same there were moments when she stole a peep at the handsome Peroo so gaily decked out with wreaths of jasmin and oleander. The marriage ceremonies had been completed, with all their rites of fire and oil and sugar-candy—a strange mixture of the mysterious and the childish—and Nellama was to be conducted to her husband's house.

Peroo was a conjurer by profession. It had been his father's and his grandfather's before him for many generations, and he was reckoned a prince amongst his people, for he had restored to the tribe the art of suspended animation. This was his story.

Many years ago his great-grandfather had made a reputation which still survived in the village, though the old man had been dead many years. The tale was still told in the place, of how the old Peroo—they all bore the same name—had been buried alive before some great English Sahibs; how rice had been planted above his grave and had blossomed into ear and yellowed to harvest; how it had been cut; and then only had the grave been opened. The opening took place before the English gentlemen, and—so it was reported and unhesitatingly believed by the villagers—Peroo was found alive. It was a great triumph for the tribe, and brought them much wealth. People from all parts came to see the wonder, and to bring offerings to one who was so favoured by the gods. Time passed, and Peroo became an old man; the trick was beyond his powers, and he began to think of passing his mantle on to the shoulders of others. But heredity had something to do with it; and, alas that it should be so! none other of the tribe was found to be so gifted. They brought him strong young men, handsome boys and fine babies; he prepared them and made the necessary passes, but without result. Great was the consternation and grief as year after year went by and no one was found to perform the miraculous feat. One day, when the old man's son and grandson were absent on one of their long itinerating rounds, performing their tricks and gathering rupees from town to town, a girl of sixteen came screaming into his room. She was the wife of his grandson. 'My son is dead! Stiff and cold I found him in his little bed. Come and see.'

Old Peroo hobbled off to the women's side of the house. The women had already begun their weeping and mourning. He thrust them all aside with small ceremony and bent over the boy. As he examined him, a sudden light sprang into the old man's eye. He stood up and clasped his hands as he cried: 'The gift! the gift!'

Then passing his hands over the body, the rigidness disappeared; under his touch the child heaved a deep sigh, drew in his breath, and opened his eyes. The women stood looking on in awe and wonder, and one old crone, who remembered Peroo's performances in his young days, took up the joyful cry, and sped through the village to tell it. Peroo ordered some food to be brought. When the child had been fed, he sent away the women; five minutes later he was leaning over the rigid form once more. Yes, it was true; power had been restored to the family once more, and his old eyes had lived to see it. He sat by the charpoy on which the unconscious boy lay, and watched him for the space of an hour; then

he recalled him to life. The little lad sat up and rubbed his eyes.

'I have had dreams, grandfather; I dreamt that I was a bird on a cliff, and I saw myself sleeping below; you watched by my side, even as you are watching now.'

The old man smiled; he had not forgotten his own dreams. When the two men came back they were told the great news. Old Peroo had a long interview with his son and grandson, and he showed them many strange things. He gave minute directions how the ears and nostrils were to be stopped with clay; how the body was to be clothed; how the restorative passes were to be made. He told them about the tomb for incarceration, and the care that must be observed in its preparation; failure in this respect might cost the performer his life. Then the old man took to his bed; there was nothing more to live for; he had laid his mantle on the shoulders of another, and the honour of the family was preserved. The next morning they found him dead.

The younger Peroo grew up to strong and lusty manhood, and on this important day, when the whole village was rejoicing, he was taking to himself a wife, the sweet and gentle Nellama, as good and obedient a girl as ever breathed. Who shall say that there is no love amongst these Hindu maids? It is only the highest castes that are *gosha*, or hidden. Nellama's family, though wealthy, was not of high caste, and she had never been doomed to a life behind the curtain. She and her companions had run about the village as children, and from babyhood she had known Peroo. When her parents had betrothed her to him, both he and she had allowed their thoughts to dwell on each other, and mutual love had sprung up with tropical rapidity. The young people were not allowed the liberty permitted to English lads and lasses in their courting; but these very restraints only served, like the blast on the fire, to fan the flame the brighter.

Nellama's sisters, aunts, and cousins stood around her as she awaited the escort which was to take her to the house of the bridegroom.

'Lucky girl!' exclaimed a young matron still in her teens. 'Peroo has plenty of fine jewels to hang round your neck; and his house is full of brass and copper pots.'

'But what says Runga? Look at his scowling face! It is ugly with disappointment and anger,' said another girl.

Nellama gave a little shiver of fear at the mention of the discarded suitor's name. She had had nothing to do with his rejection; Hindu maidens are the last people to be consulted in such matters, even though they have to play the important part of bride.

'Ah, Nellama! The bridegroom is coming to carry his bride to his house!' cried the girls in the greatest excitement.

As the procession approached the house, it was met by an official in gorgeous dress, scarlet coat, and turban of white and gold. He was only a servant, but the glory of his master's office was reflected in the magnificent person of the man. He was the chuprassee of the English Government agent who ruled the province in the Queen's name. It had come to his worshipful ears that Peroo could perform that most wonderful feat of being buried alive, and he would see it. He could honour his poor village with his presence, if he would consent to perform before him. Peroo signified his willingness to accede to the Commissioner's request, after receiving a hint as to the remuneration.

The wedding festivities proceeded with even greater zest and spirit than before. This was good news; and the profits of the show would pay for all the wedding expenses, which, as usual, were large in proportion to the means of the family. There was one person, however, who did not join in the general rejoicing, and that was Nellama. She was proud enough of her handsome husband; and she meant to sing his praises loudly every morning, when she went to the well with the other women to draw water for the house. But in her secret heart she feared Runga's jealousy. The man had taken his jilting with a bad grace; he had not been treated well over the matter of the wedding, although Nellama's father was quite justified in giving his daughter, according to their custom, to the richer suitor. Moreover, he was consumed with envy over his rival's professional success. He considered that the precious gift should by right have been his, he being Peroo's senior by two or three years, and he imagined that he had in some way been deprived of his birthright by the younger man. If Peroo were removed, it might come to him. He had let drop sentiments of this kind in Nellama's hearing in days gone by, and they returned upon her with force, now that Peroo had grown so dear. Indian women love passionately, and their instincts teach them to guard vigilantly and look with suspicion on their enemies. Runga was an enemy, and the beautiful girl trembled for her prosperous husband as his success increased.

'I will watch him like a mother,' she whispered to herself, as she crept away from his sleeping form that wedding night, and laid herself before the door like a faithful hound. 'No hand but mine shall prepare his food; no foot shall cross the threshold of his sleeping room except over my body.'

Four days later the chuprassee in his gorgeous coat and turban appeared again in the village. He was more important than ever, and made almost a royal progress to Peroo's house, attended by a crowd of admiring villagers.

'He bade me say that he would be here at four o'clock,' was the message from his Excellency. All was now ready. The news spread through the village rapidly, reaching the outlying hamlets by noon, and a steady flow of visitors set in for the two hours preceding the performance. At eleven the grave was finished, and the men returned to their houses for dinner—a meal of curry and rice. Nellama had everything ready for her Peroo. She had taken infinite pains in the preparation of his last meal; and she was more than rewarded for her trouble by the evident approval and pleasure written on his face,

as she placed the dish of white rice and the basin of savoury curry before him with the little brass bowls of various chutneys he loved so well. Hindu women do not dine with their husbands, and Nellama had no appetite for the portion of food she had put aside for herself. Her mind was too uneasy about her husband. Drawing her cloth over her head, she slipped out into the field, intending to run across and have one more look at the grave, now that the workmen had all departed, and before the sightseers began to arrive. As she passed behind the cactus hedge that divided her little pumpkin garden from the field, she caught sight of a form stealing away from the grave. He turned his head and looked at her, and she shuddered, for there was an evil smile upon Runga's face as his eyes met hers. What could he have been about?

'I will sift his villainy to the very bottom!' she said, as she hurried towards the spot. 'Nothing shall escape my eye. I will look into every nook and cranny to see that the wicked Runga has not put any cunning and deadly poison to destroy the life of my husband. Ah, if I can only catch him in his wickedness, I will appeal to the Commissioner himself to have him punished.'

Nellama found nothing but bare walls smooth with freshly plastered mortar. The little room was like a box, and perfectly empty. There could be no room for villainy there, surely, with the midday sun shining down into its moderate depth, illuminating every inch of space. Her fears subsided, and she sat down by the vault determined not to leave it again till Peroo's father arrived. She saw her husband come out of his house and look round for her. But she knew that he did not want her; it is not the thing for a Hindu to be seen chatting with his wife in broad daylight. So she sat there, patiently keeping guard till the appointed hour.

The crowd gathered during the afternoon, and after looking at the grave, the people sat down to chat and watch for the procession. It came from the village with the usual accompaniment of tom-toms and horns, and with apparently the whole village in its wake. It was one of those tropical scenes of colour and light which it is impossible to place upon canvas. The centre figure was that of Peroo, dressed in white and gold, and adorned with garlands of oleander flowers. He was carried on the shoulders of his tribesmen and brother conjurers. The Commissioner and his friends walked apart with a look of amusement and interest on their faces. When they reached the grave they were invited to examine anything they pleased. This they did, and in no cursory manner, for it was a scientific experiment to them of the keenest interest. They found the grave to be nothing but what it professed—namely, a square vault, with unburnt brick walls and floor. Peroo had eaten his usual dinner, cooked for him by his faithful little wife, and his father had given him a drink of some herbal mixture just before starting.

The eyes of all were fixed upon Peroo's father as he commenced the mysterious rite of putting his son to sleep. The chattering of the crowd ceased, and there was a breathless silence.

'What are you doing?' asked the Commissioner.

The man made no secret of it, but readily explained each process.

'See, your honour, I place these small pellets of clay in my son's ears, and these in his nostrils.'

He made some passes, and Peroo showed symptoms at once of mesmeric slumber. Then he turned back the tongue so that it formed a stopping to the throat. One of the Englishmen laid a hand upon the unconscious man's shoulder and shook him, but there was no response. The men who were assisting now began to arrange the body as if for burial; they folded his arms on his breast and straightened out his legs. Apparently life had fled, for there was no respiratory movement, and a yellow tinge crept over the face, replacing the ruddy brown tint of health.

'I don't like that colour,' said one of the visitors, who possessed some medical knowledge. 'It is uncommonly like death.'

He laid his finger upon the man's pulse.

'And I believe he is dead, too,' he continued in evident consternation. 'His pulse has ceased entirely. They have killed him to get the money!'

The Commissioner was startled; no one knew better than he how small a value the Hindu puts upon the human life.

'Wake him!' he cried imperatively.

Peroo's father hesitated.

'My son lives,' he said confidently.

'That may be, but we would see for ourselves,' replied the Englishman in a tone that intimated he meant to be obeyed.

The man was loth to undo his work, for he understood nothing of the fear that influenced the other. However, the Commissioner's will was law. The pellets were removed, the tongue drawn back from the throat, and Peroo began to breathe softly and regularly like a child in its sleep.

'Shall I wake him?' the father asked, waiting for further orders.

'No, you may finish the performance,' said the Commissioner. He was relieved of anxiety and satisfied that the men were acting fairly. The pellets were accordingly replaced, and the body resumed its death-like appearance. Peroo was laid in the vault just as though he were dead, but without the usual signs of mourning which mark the presence of death. Even Nellama's vague fears of evil were allayed, and she watched the preparations for closing the tomb with relief and satisfaction. He would be safe from Runga's malice there, and never a doubt crossed her mind of the power of Peroo to return to life when his father should bid him.

A stone was placed on the mouth of the grave, and the masons mortared it down; soil was spread on the top and sown with corn in rows, so that it would be impossible to disturb it without detection. The Commissioner and his friends watched the process from beginning to end, and were the last to leave the spot,

excepting for the faithful Nellama; but she too had to creep away as the night fell.

But all unseen to the watchful eyes of Nellama, on the morning of the fourth day a tiny insect entered the grave. It moved timidly—pausing, hesitating, and making as though it would go back, yet always returning and steadily progressing. With the unerring instinct of its species it advanced until it reached the motionless body. It mounted inch by inch with laborious perseverance, retracing its steps, exploring, feeling, testing with its tiny antennæ, till it came to the closed and sightless eyes. There it stood as motionless as the unconscious man except for the nervous tremor of the antennæ. Suddenly it turned and left the body, making straight for the hole by which it had entered, so cunningly bored through the unburnt brick and the plaster into the soft earth beyond. Hours passed, and nothing moved within the living grave. At midnight two slender horns were pushed through the tunnel, and the pioneer descended the wall on its old track. It had carried its message to the hordes of its clan, and legion upon legion followed in its train. The soul saw it all, and a great agony seized it. It strove to speak; it strove to move that mortal log, through which it was wont to find means for the expression of its emotions and to feel earthly pleasure and pain. One shake of the hand, one thrust of the foot, and the foe with its legions would flee. But the soul was powerless. On streamed the torrent in an ever-increasing flood, till it grew to a vast, seething mass of busy atoms. On, on went the pioneer of the band till once more it stood before the sightless eyes.

Peroo was to lie in his grave till the green blade sprang above it. Both he and his father had expressed their willingness to make that period longer. The old Peroo had been buried from seed-time till harvest, and the younger man had no reason to doubt that his powers were inferior to those of his ancestor. But the Commissioner willed it otherwise. He said that he would be content to have the corn in the green blade—so goes the story. Nellama was counting the days to her husband's release. She had chosen the fowl which was to make his first dish of nourishing mullagatawny. She promised herself that the broth should be strong and good, and enriched with stimulating herb and seed.

On the morning of the appointed day, Runga chanced to pass her in the village street; there was a grim and evil smile upon his face which she did not understand. Why should he smile as his successful rival's hour of triumph drew near? A large crowd gathered to see the opening of the grave. Men with shovels stood ready to remove the earth at the bidding of the Commissioner. But before the order was given, he and his friends fully satisfied themselves that there had been no trickery.

'Neither food nor air can possibly have been introduced, as far as I can see. By all the laws of nature the man ought to be as dead as a red-herring,' said one of the scientific men.

But the Commissioner did not look at all anxious.

'We shall find him alive all right, but rather exhausted, probably. These Hindus undoubtedly know something about this mysterious state called suspended animation,' he replied.

At the given signal the coolies set to work; the stone was bared, the mortar was chipped away, and the heavy slab levered up. The Commissioner himself was the first to descend into the grave, followed quickly by Peroo's father. Nellama, prompted by love and curiosity, pressed forward through the throng, and leaned over to look into her husband's tomb. The air was rent by a terrible shriek; there was a cry of consternation from the Englishmen, and a groan of despair from Peroo's father.

A white skeleton lay at their feet. Peroo had met with the one dread fate that is so much feared by all who practise his art. He had been eaten by ants. No call save the last Great Call on the Judgment Day could ever reclothe his departed soul with flesh.

Bitterly did his young wife blame herself that her eyes had failed to detect the hole so cunningly bored. But detection was impossible, for the fiend who had made it had plugged it with sweetened rice flour, knowing well that no creature on earth but an ant would discover it, and that the discovery would be swift and sure.

FIVE O'CLOCK TEA.

WHAT shall we find when the play is done
At the sign of the Pekoe Tree?
A cup and a welcome for every one,
And a corner for you and me.
A glimpse of æsthetic daintiness,
An air of Bohemian ease, no less,
And a corner for you and me;
Where one may sip and dream if he will,
And fancy the world is standing still,
At the sign of the Pekoe Tree!

Fair Phyllis as well, polite, alert,
We shall find at the Pekoe Tree;
Not over demure, nor yet too pert,
As she waits upon you and me.
Prettily gowned, and daintily neat,
With deft white hands, and a smile discreet,
As she waits upon you and me.
So, please, no excuse. Fagged out or 'fit,'
Or merry, or dull, what matters it—
We can meet at the Pekoe Tree!

J. J. D.

*** TO CONTRIBUTORS.

1st. All communications should be addressed to the 'Editor, 339 High Street, Edinburgh.'

2d. For its return in case of ineligibility, postage-stamps should accompany every manuscript.

3d. To secure their safe return if ineligible, ALL MANUSCRIPTS, whether accompanied by a letter of advice or otherwise, *should have the writer's Name and Address written upon them* IN FULL.

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